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ABSTRACT

This experiment tested the hypothesis that the sequence of ability and effort attributional feedback influences children's attributions, self-efficacy, and skillful performance. Children deficient in subtraction skills received training on subtraction operations and solved problems over four sessions. During the problem solving, some children periodically received ability feedback whereas others were given effort feedback. Children in a third condition received ability feedback during the first two sessions and effort feedback during the last two; this sequence was reversed in a fourth condition. Childen who initially received ability feedback developed higher levels of self-efficacy and skill and placed greater emphasis on ability as a cause of task success compared with subjects initially given effort feedback. Future research should explore how students interpret forms of attributional feedback as their skills develop on different types of tasks. (Author)

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Sequential Attributional Feedback: Differential Effects on Achievement Behaviors

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Abstract

This experiment tested the hypothesis that the sequence of ability and effort attributional feedback influences children's attributions, self-efficacy, and skillful performance. Children deficient in subtraction skills received training on subtraction operations and solved problems over four sessions. During the problem solving, some children periodically received ability feedback whereas others were given effort feedback. Children in a third condition received ability feedback during the first two sessions and effort feedback during the last two; this sequence was reversed in a fourth condition. Children who initially received ability feedback developed higher levels of self-efficacy and skill and placed greater emphasis on ability as a cause of task success compared with subjects initially given effort feedback. Future research should explore how students interpret forms of attributional feedback as their skills develop on different types of tasks.

Sequential Attributional Feedback:
Differential Effects on Achievement Behaviors

Bandura's theory of self-efficacy states that different treatments change behavior in part by creating and strengthening a sense of self-efficacy (Bandura, 1977, 1981, 1982). Self-efficacy refers to judgments of how well one can organize and implement actions in specific situations that may contain ambiguous, unpredictable, and stressful features. Self-efficacy is hypothesized to influence one's choice of activities, amount of effort expended, perseverance when difficulties are encountered, and actual task accomplishments.

People acquire information about their level of self-efficacy through self-performances, socially comparative vicarious means, persuasory influences, and physiological indexes. Although self-performances provide the most reliable efficacy information, efficacy judgments are not isomorphic reflections of those performances. Efficacy appraisal is an inferential process that involves weighting the relative contributions of both ability and nonability factors, such as self-perceptions of ability, amount of effort expended, task difficulty, amount of external aid received, situational circumstances under which the performances occurred, and temporal pattern of successes and failures (Bandura, 1981, 1982).

In this view, attributional variables constitute a major influence on self-efficacy. Attributional theories of behavior

hypothesize that people make causal ascriptions for the outcomes of their actions (Heider, 1958; Kelley, 1967; Kelley & Michela, 1980). In achievement contexts, outcomes often are attributed to ability, effort, task difficulty, and luck (Frieze, 1980; Weiner, 1979; Weiner et al., 1971). Future expectancies of success and failure heavily depend on ascriptions for prior outcomes (Weiner, 1977, 1979). For example, if one believes that the conditions surrounding a task will remain much the same, attributions of prior successes largely to relatively stable causes, such as high ability or low task difficulty, should result in higher expectancies of future success than should attributions to the more unstable causes of great effort or good luck (Frieze, 1980; Frieze & Weiner, 1971; McMahan, 1973; Weiner, 1979).

Research with children has demonstrated that they value high ability and high effort and use both to explain successes in achievement settings (Frieze, 1980; Frieze & Bar-Tal, 1980; Frieze & Snyder, 1980; Harari & Covington, 1981). As Nicholls (1978) has shown, however, important developmental changes occur in children's conceptions of ability and effort. Very young children view effort as the prime cause of outcomes and ability-related terms as closely associated. Around age nine a distinct conception of ability begins to emerge. There is developmental evidence that third graders use inverse compensation in judging effort from ability information (Kun, 1977; Surber, 1980); that is, children infer less effort as outcomes are presented as

resulting from higher ability. Developmental research also shows that some third graders use inverse compensation in judging ability from effort information (Surber, 1980). Ability attributions become increasingly important in explaining successes as children become older, whereas effort as a causal factor declines in importance (Nicholls, 1978, 1979).

The effects of ability and effort information on achievement behaviors also have been investigated in attributional feedback studies (Andrews & Debus, 1978; Chapin & Dyck, 1976; Dweck, 1975; Medway & Venino, 1982; Miller, Brickman, & Bolen, 1975; Schunk, 1982, in press-a). For example, because effort presumably is under volitional control, telling children that their past failures were due to insufficient effort should have motivational effects and lead to greater persistence and higher performance (Dweck, 1975). Research also shows that effort attributional feedback for prior successes enhances children's self-efficacy (Schunk, 1982, in press-a).

Positive effects on achievement behaviors also have been obtained from providing children with ability attributional feedback for their prior successes (Miller et al., 1975; Schunk, in press-a). Thus, children who are told that their successes resulted largely from high ability should expect future successes and perform at a high level. In the Miller et al. (1975) study, ability and effort attributional feedback were equally effective in increasing children's arithmetic performances; however, their

second-grade subjects may not have begun to differentiate ability from effort. Using third-grade children, Schunk (in press-a) found that ability feedback led to higher levels of self-efficacy and subsequent skillful performance compared with effort feedback.

An issue that has not been systematically explored is how the sequencing of attributional feedback affects children's achievement outcomes. Early successes at a task constitute a cue used to arrive at ability attributions (Frieze & Weiner, 1971; Weiner, 1974). When children work at a task and experience early successes they are apt to believe that they are able and develop a sense of efficacy for continued success. Telling them that ability was responsible for their successes should substantiate these self-perceptions. Once children form ability attributions and a strong sense of efficacy, subsequently providing effort feedback may not alter these views much. Children may interpret the effort feedback more as an observation of how diligently they have been applying their capabilities to the task than as an indicator of those capabilities. Conversely, providing effort feedback for early successes informs children that they can succeed with hard work, which should not foster ability attributions or a sense of efficacy as well as ability feedback. Even if children subsequently were given ability feedback they might question its credibility somewhat because of having been told previously that they had to work hard to succeed.

The purpose of the present study was to determine how the sequencing of ability and effort attributional feedback influences children's attributions for task success, self-efficacy, and skillful performance. Third-grade children participated in a subtraction competency-development program and periodically received attributional feedback for their problem-solving progress. One group of children received ability feedback throughout the program (ability-ability), a second group exclusively received effort feedback (effort-effort), a third group was given ability feedback during the first half of the training program and effort feedback during the second half (ability-effort), and for a fourth group this sequence was reversed (effort-ability).

It was predicted that providing ability feedback during the first half of training would lead children to emphasize ability as a cause of task success and result in higher levels of self-efficacy and subtraction skill than the initial receipt of effort feedback. Children in the latter two conditions (effort-effort and effort-ability) were expected to place greater stress on effort as a cause of task success. It also was predicted that the two conditions initially receiving ability feedback would not differ on achievement outcomes, nor would the two conditions initially receiving effort feedback.

Method

Subjects

The sample included 40 third-grade children drawn from four classes in one elementary school. Ages ranged from 8 years 3 months to 10 years 5 months (M = 9.3 years). The 21 boys and 19 girls were predominantly middle class. Because this study focused on processes whereby skills could be developed when they were lacking initially, children's teachers were shown the subtraction skill test and identified children who they felt could not solve correctly more than about 25% of the problems. These children were administered the pretest individually by one of two female adult testers who were drawn from outside the school.

Pretest

Self-efficacy judgments. Self-efficacy for solving subtraction problems correctly was measured following procedures of previous research (Bandura & Schunk, 1981; Schunk, 1981, 1982, in press-a). The efficacy scale ranged from 10 to 100 in 10-unit intervals from high uncertainty (10), through intermediate values (50-60), to complete certitude (100). Children initially received practice with the efficacy assessment by judging their certainty of successfully jumping progressively longer distances. In this concrete fashion, children learned the meaning of the scale's direction and the different numerical values.

Following this practice, children were shown 25 sample pairs of subtraction problems for about 2 s each. This brief exposure

allowed assessment of problem difficulty but not actual solutions. The two problems constituting each pair were similar in form and operations required, and corresponded to one problem on the ensuing skill test although they were not identical. Children were judging their capability to solve different types of problems and not whether they could solve any particular problem. Children made their judgments privately by circling an efficacy value. They were advised to be honest and mark how they really felt. Self-efficacy scores were summed across the 25 judgments and averaged.

Subtraction skill test. The skill test, which was administered immediately following the efficacy assessment, included 25 subtraction problems ranging from two to six columns. Each problem tapped one of the following subtraction operations: no borrowing, borrowing once, borrowing from a one, borrowing twice, borrowing caused by a zero, and borrowing across zeros. Of these 25 problems, 12 were similar to some of the problems that children solved during the subsequent training sessions, whereas the other 13 were more complex. For example, during training children solved problems requiring double borrowing, whereas some skill test problems required triple borrowing. The measure of skill was the number of problems that children solved correctly.

The tester presented the problems one at a time and verbally instructed children to examine each problem, to decided how long they wanted to spend on it, and to place each page on a completed

stack when they finished solving the problem or chose not to work on it any longer. Children were given no performance feedback.

Training Procedure

Following the pretest, children were randomly assigned within sex and classroom to one of four treatment groups (ns = 10) distinguished by the sequencing of ability and effort attributional feedback: ability-ability, ability-effort, effort-ability, effort-effort. Children received 40-minute training sessions over four consecutive school days, during which they worked on a training packet consisting of seven sets of material. These sets were ordered in terms of least-to-most difficult as follows: no borrowing, borrowing once in two-column problems, borrowing once in three-column problems, borrowing once caused by a zero, borrowing twice, borrowing from a one, and borrowing across zeros (Friend & Burton, 1981). The format of each set was identical. The first page contained written explanation of the subtraction operations and two step-by-step worked examples. The next six pages each contained several problems to solve.[1]

Each child was escorted individually to a large room by one of two female, adult proctors. For any given child, the proctor had not served as the child's tester. Each proctor was responsible for approximately equal numbers of children in each treatment condition. Children were seated at sufficient distances from other children to preclude visual and auditory contact.

Initially, the proctor reviewed the first explanatory page by pointing to the operations while reading from a narrative that explained the steps. If children indicated a lack of understanding, the proctor reread the relevant narrative but did not supplement it on her own. The proctor explained that whenever children came to a similar page they were to bring it to her for review. The proctor then stressed the importance of careful work, and retired to an out-of-sight location. Children solved problems alone and received no performance feedback on the accuracy of their work. They marked their places at the end of each session and resumed there the following day.[2]

Treatment Conditions

Ability-ability feedback. The proctor monitored the progress of these children about every 8 min during all four training sessions by walking up to each child and asking, "What page are you working on?" After children replied with the page number, the proctor linked their prior problem-solving progress to ability by remarking, "You're good at this." This feedback was given in a matter-of-fact tone of voice and without accompanying social reinforcers such as smiles or pats. The proctor then departed.

Ability-effort feedback. Children assigned to this treatment condition received ability feedback as described above during the first two training sessions. During the third and fourth sessions, the proctor instead linked children's prior progress with effort by remarking, "You've been working hard." This remark

also was given matter-of-factly and without accompanying social reinforcement, after which the proctor departed.

Effort-ability feedback. The proctor monitored these children in the same fashion as the preceding conditions. During the first two sessions children exclusively received effort feedback ("You've been working hard"), whereas during the last two sessions the proctor only delivered ability feedback ("You're good at this").

Effort-effort feedback. The procedures followed for children assigned to this treatment condition were identical to those of the above conditions except that children exclusively received effort feedback throughout the training program.

Attributions

Children's attributions for their problem-solving progress during training were assessed on the day following the last session. Four scales were shown on a sheet of paper; each scale ranged in intervals of 10 from "not at all" (0), through intermediate values (40-60), to "a whole lot" (100). The four scales were labeled "good at it" (i.e., ability), "worked hard" (effort), "easy problems" (task), and "lucky" (luck). Label order was counterbalanced across subjects.

The tester explained that this paper showed four things that help children work problems. The tester described the scale and each of the attributions, and provided examples of how hypothetical children might mark the scales. Children were

advised to think about their work during the training sessions and to mark how much they thought each factor helped them to solve problems. The tester explained that children's marks did not have to add to a certain number (e.g., 100). Children privately recorded their ratings.[3]

Posttest

The posttest was administered the day following the attributional assessment. The instruments and procedures were similar to those of the pretest except that a parallel form of the skill test was used to eliminate possible problem familiarity. The parallel form was developed in previous research (Bandura & Schunk, 1981); the two forms correlated highly (r = .87) in a reliability assessment conducted in conjunction with that study.

For any given child, the same tester administered both the pre- and posttests and was blind to the child's treatment condition. All tests and training materials were scored by an adult who was unaware of children's experimental assignments.

Results

Means and standard deviations of all measures are presented by experimental condition in Table 1. Preliminary analyses revealed no significant differences due to tester, classroom, or sex of child on any measure, nor any significant interactions. The data therefore were pooled across these variables. There also were no significant differences between experimental conditions on the pretest measures.

Insert Table 1 about here

Self-Efficacy/Skill

Posttest self-efficacy and subtraction skill were analyzed with a multivariate analysis of covariance using the corresponding pretest measures as covariates. The four experimental conditions constituted the treatment factor. This analysis yielded a significant between-condition difference, Wilks' $\Lambda = .555$, $F(6, 66) = 3.77$, $p < .01$. Multivariate orthogonal contrasts showed that the two conditions initially receiving ability feedback significantly outperformed groups initially given effort feedback, $\Lambda = .692$, $F(2, 33) = 7.36$, $p < .01$. The ability-ability and ability-effort conditions did not differ significantly, nor did the effort-ability and effort-effort conditions. Univariate F tests revealed significant between-group differences on both measures: self-efficacy, $F(3, 35) = 8.40$, $p < .001$; skill, $F(3, 35) = 3.75$, $p < .05$. Thus, children who initially received ability feedback demonstrated significantly higher levels of self-efficacy and subtraction skillful performance compared with subjects initially given effort feedback.

Attributions

The four attributions were analyzed with a multivariate analysis of variance. This analysis yielded a significant difference between the four conditions, $\Lambda = .537$, $F(12, 87.6) =$

1.93, $p < .05$. Multivariate orthogonal contrasts revealed a significant difference between the two groups initially receiving ability feedback and those initially given effort feedback, $\Lambda = .755$, $F(4, 33) = 2.70$, $p < .05$; however, the ability-ability and ability-effort conditions did not differ significantly, nor did the effort-ability and effort-effort groups. Univariate F tests yielded a significant between-group difference only for ability attributions, $F(3, 36) = 4.49$, $p < .01$. Compared with subjects initially given effort feedback, children who received ability feedback during the first half of training placed significantly greater emphasis on ability as a cause of task success.

Training Progress

To investigate whether experimental treatments differentially affected rate of problem solving during training, an analysis of variance was applied to the number of problems that children completed during the sessions. This analysis yielded a nonsignificant result, $F(3, 36) = 2.38$. Analysis of the number of problems that children solved correctly during training also was nonsignificant.

Correlational Analyses

Correlational analyses were conducted to explore the interrelationships between variables. Product-moment correlations were computed among posttest self-efficacy and skill, the four attributions, and training progress, which was defined as the number of problems completed. Initially, correlations were

computed separately within each of the four experimental conditions. Because there were no significant between-condition differences in correlations of any measures, correlations were averaged using an r to z transformation (Edwards, 1976).

The more problems that children completed during training, the more emphasis they placed on ability a cause of task success, $r(38) = .35$, $p < .05$, and the higher were their levels of self-efficacy, $r(38) = .61$, $p < .01$, and skillful performance, $r(38) = .59$, $p < .01$. A similar pattern of results was obtained using the number of problems solved correctly during training. The higher that children judged ability a cause of task success, the higher were their efficacy judgments, $r(38) = .54$, $p < .01$, and demonstrated skills, $r(38) = .45$, $p < .01$. Attributions to luck were related negatively to skill, $r(38) = -.39$, $p < .01$. Self-efficacy bore a positive relationship to subsequent skillful performance, $r(38) = .67$, $p < .01$.

Discussion

Prior research has demonstrated that ability or effort attributional feedback for past progress during a competency-development program helps to develop self-efficacy and skills (Schunk, 1982, in press-a). The present study expands these findings by showing that in some cases the sequencing of such feedback also is important. Attributing children's early problem-solving progress to ability proved most effective in fostering self-efficacy and skills regardless of whether the

ability feedback was continued or whether children's successes instead were attributed to effort. A primacy effect due to ability feedback also was obtained on children's attributions, because children in the ability-ability and ability-effort conditions placed greater emphasis on ability as a cause of task success.

These effects may be explained as follows. As children solve problems during training they begin to develop a sense of efficacy. Telling them early in the course of skill development that ability is responsible for their task successes supports their self-perceptions of progress and substantiates this sense of efficacy (Schunk, 1982, in press-a). Early successes also constitute a prominent cue for ability attributions (Frieze & Weiner, 1971; Weiner, 1974). To the extent that ability-ability and ability-effort children formulated ability attributions early in the training program the ability feedback would have supported such attributions. When ability-effort children subsequently received effort feedback they may have viewed it more as a reflection of how diligently they had been applying their skills rather than an indicator of their level of competence. Ability attributions for successful performance result in high expectations for future success (McMahan, 1973). In turn, a strong sense of efficacy should affect subsequent test performance.

Providing children with effort feedback for early task success was not as effective in fostering achievement outcomes, even when ability feedback was given later on. Effort attributional feedback conveys that children can succeed with hard work (Schunk, 1982). Developmental evidence shows that some third graders use inverse compensation in judging ability from effort information (Surber, 1980), and the same degree of success resulting from greater effort should not strengthen self-efficacy as much as when less effort is required (Bandura, 1981). Because the present sample should have begun to differentiate ability from effort, children in the effort-ability and effort-effort conditions may not have felt highly capable, which would not have fostered ability attributions. Effort-ability subjects may have questioned the credibility of the ensuing ability feedback after repeatedly being told that their successes were due to hard work. A lower level of self-efficacy relative to that of children who initially received ability feedback was associated with a lower level of skillful test performance.

This explanation is consistent with previous research comparing ability with effort attributional feedback (Schunk, in press-a). In that study, some children received only ability feedback, others were given only effort feedback, and children in a third condition received both types of feedback simultaneously. Although children in this combined condition developed equally high self-efficacy and skills as effort-only subjects, the

ability-only group demonstrated the highest levels of self-efficacy and skill. Children in the combined condition apparently discounted the ability feedback in favor of the effort information.

Contrary to prediction, children who received effort feedback during the first half of training did not place greater emphasis on effort as a cause of success compared with subjects initially given ability feedback. This finding may not be too surprising, because children's effort attributions reflected successful effort. High effort as a cause of success is valued by children (Frieze, 1980; Frieze & Snyder, 1980; Harari & Covington, 1981), especially when paired with the perception of high ability (Covington & Omelich, 1979c). Young children often believe that high effort can enhance ability, although with development there is a progressive devaluation of effort (Harari & Covington, 1981). Conversely, high effort that might result in unsuccessful outcomes may be shunned by students because this situation implies low ability (Covington & Omelich, 1979b; Kun & Weiner, 1973).

The validity of the present ability and effort attributional feedback depended on children viewing the task as average in difficulty, which the present procedures were designed to foster. Ability feedback on tasks thought to be very easy should not enhance self-efficacy because such feedback should duplicate what children already know. Providing ability feedback on very difficult tasks might be viewed with some skepticism because as

tasks become difficult a combination of ability and effort is necessary to succeed (Kelley, 1971). Similarly, effort can make the greatest difference in outcomes on intermediate-difficulty tasks (Kukla, 1972; Weiner, Heckhausen, Meyer, & Cook, 1972). Telling children that they worked hard on a task they thought was very easy should not enhance self-efficacy. Effort feedback also may not promote self-efficacy much on a task children viewed as highly taxing because they might wonder if they could sustain the high level of effort required for continued success.

Consistent with previous similar research, the present study supports the idea that although self-efficacy is influenced by prior self-performances it is not merely a reflection of them (Schunk, 1981, 1982, in press-a). Treatment conditions did not differ in rate or accuracy of problem solving during training but children who initially received ability feedback judged self-efficacy the highest. The present study also supports the idea that capability self-perceptions bear an important relationship to subsequent skillful performance (Covington & Omelich, 1979a; Schunk, 1981). Personal expectations for success are viewed as important influences on behavior by a variety of theoretical approaches to achievement (Bandura, 1981; Covington & Beery, 1976; Kukla, 1972; Schunk, in press-b; Moulton, 1974; Weiner, 1979).

Future research might explore how differential sequencing of attributional feedback affects achievement outcomes on other types

of tasks. On a difficult task, for example, students initially might have to expend much effort to enjoy some success, in which case effort feedback could be perceived as more valid than ability feedback. As students begin to develop some skills and a sense of efficacy, attributing their successes to ability might better enhance these outcomes. Knowing how students interpret forms of attributional feedback as their skills develop on different types of tasks also would have important implications for teachers.

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Footnotes

[1]For the attributional feedback to be valid children had to succeed at solving problems. The training packet was designed toward this end. Each explanatory page fully covered the operations required to solve the problems on the six pages that followed.

[2]As a check on children's success at solving problems, each proctor privately reviewed her children's work after they departed each day. Allowing for occasional small computational errors, children solved the problems correctly.

[3]This attributional assessment is an example of a structured unidimensional scale (Elig & Frieze, 1979). Such scales assume independence of ratings and allow attributions to be assessed separately. A structured scale was chosen because young children seem to understand it more readily than an unstructured assessment (Diener & Dweck, 1980). Structured unidimensional scales yield attributional dimensions similar to those of structured ipsative scales, in which an individual judgment influences other judgments (Maruyama, 1982).

Table 1

Means (and Standard Deviations)

Measure	Phase	Experimental Condition: Ability-Ability	Ability-Effort	Effort-Ability	Effort-Effort
Self-Efficacy[a]	Pretest	36.3 (10.2)	35.4 (10.3)	32.9 (11.2)	35.8 (12.1)
	Posttest	87.6 (11.3)	87.8 (8.3)	65.3 (16.5)	72.4 (11.3)
Skill[b]	Pretest	4.1 (1.4)	3.8 (1.8)	3.7 (2.1)	3.5 (2.3)
	Posttest	19.3 (4.2)	17.4 (5.9)	12.3 (5.9)	12.6 (6.2)
Training Progress[c]	---	207.8 (45.0)	186.4 (50.0)	159.7 (64.8)	210.2 (23.1)
Ability[d]	---	83.0 (19.5)	85.0 (12.7)	59.0 (13.7)	71.0 (23.8)
Effort[d]	---	82.0 (16.7)	95.0 (9.7)	89.0 (16.6)	81.0 (15.2)
Task[d]	---	68.0 (19.3)	68.0 (23.5)	60.0 (24.9)	72.0 (18.7)
Luck[d]	---	30.0 (27.9)	38.0 (27.0)	36.0 (15.8)	37.0 (26.7)

Note. N = 40; ns = 10.

[a]Average judgment per problem; range of scale: 10 (low) - 100.

[b]Number of correct solutions on 25 problems.

[c]Number of problems completed.

[d]Range of scale: 0 (not at all) - 100.